

An Immense Review on Comparative Analysis between Regular and Irregular Multistoried Building under Seismic Loading

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Abstract— With growing Use of Multistoried buildings in India has become common, it has been in necessity of human beings to acquire particular space for their residential living in this type of freely environment. To make it more fascinate use of irregular shaped structures has modernized. The technical reason behind this modernization is that minimize effects of torsion on building and also to make the structure more ecofriendly and economical. The plan of the research in the present article has been obtained depending on previous studies on irregular building with shapes such as H-shaped, L-shaped, T-shaped, V-shaped, U-shaped etc., with different parameters being studied and compared on the structures having regular frame. The further study can be done by taking irregularity in the buildings by making floor in different directions such as east, west, North and south etc. and also by changing the grades of concrete.

Keywords— Concrete Grade, Dual system, Irregular Building, Lateral load capacity, Shear Wall.

I. INTRODUCTION

The natural calamities are very unwanted and disrupting and earthquake is one of them. From this, it is most difficult to save the structural properties and life. To surmount these calamities we are required to calculate the behavior of the build atmosphere on seismic zone by enhancing development of different analytical methodologies, which gives security to the buildings to survive during several insignificant earthquakes and also gives a sufficient suitable warning at the time of major earthquake calamities. The seismic behavior of a building is based on various factors such as stiffness, sufficient lateral strength, ductility, configuration etc. During an earthquake, In contrast to irregular configurations structures with regular shape and UDL and stiffness in both elevation along with the plan undergo much less damage Most of engineers & architects prefer to build irregular plan structures and mostly it is impossible for them to keep this idea ascertain.

II. REVIEW OF LITERATURE

In this paper analysis & Modelling of a wind tunnel is done and pressure due to wind is determined on several faces of typical plan shape structures. The closed circuit of tunnel of a wind having flow of boundary layer is used to examine models having similar region and height. The preparation of models is done on the perplex sheets with a geometrical scale of about measurement of 1:500. The comprehensive range of angle of wind direction from 00 to 1800 at an interval of 150 is done by using geometry of model by variating pressure distribution at the surface. Change in pressure along the height and also along width of faces of the buildings models is examined to be huge. The value of peak pressure coefficient also differs significantly with direction of the wind in both position as well as magnitude (J.A. Amin, A.K Ahuja, 2008).

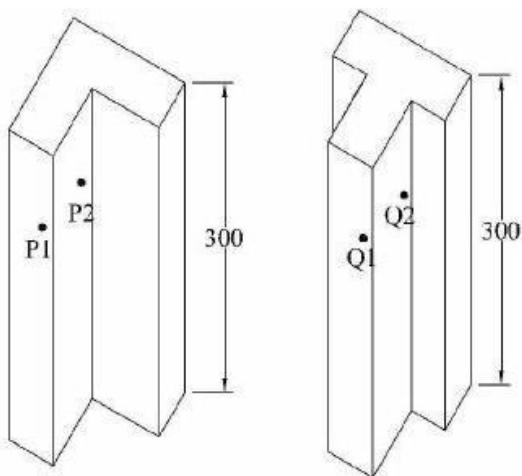


Fig.1: Plan of Building model of L-shaped building & T-shaped building respectively (J.A. Amin, A.K Ahuja, 2008)

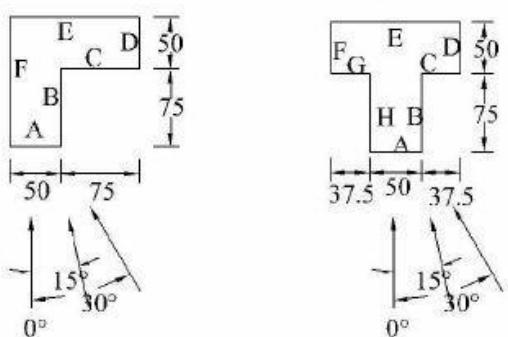


Fig.2: Isometric view of Building model of L-shaped building & T-shaped building respectively (J.A. Amin, A.K Ahuja, 2008)

The object of study included the effect of torsion along with that behavior of asymmetric building is analyzed by modeling a 14 storey building with software Tabs as per IS code 1893:2002 (part-I). During occurrence of an earthquake in building, torsion arise due to various reasons along the height of building. Most common is unsymmetrical distribution of stiffness and mass. In this paper dynamic analysis method (i.e., Response spectrum method) is adopted in which two types building are considered, one is square building 25m x 25m and other one is L shape building for determining the vibration, storey drift and displacement on each floor. In Irregular building (L Shape) displacement and storey drift is high. Frequencies vibration results as low in regular building and values of Torsion are less in irregular building. (Shaik munnur hussain, Dr. Sunil kumar tengli, 2018)

The objective of this research is to analyze the seismic effect of the building of geometrical plan configurations and compare the analysis on various parameters i.e. axial

forces, displacement, base shear, bending moment, shear force, etc. For this analysis response spectrum method has been used and it is analyzed by using STAAD Pro software. In this analysis a regular square shape building in plan is analyzed and the same is compared with H-shape plan building. Also, all the data being used for this analysis are same i.e. size of column, beam, height of floors, etc. The results of this analysis have been compared using graphs and by graphical illustration of displacement of both the buildings, axial forces, stress distribution through the height of the building etc. This study has been carried out to examine the effect on the stability of the building under seismic analysis and to make an easiness in the selection of the shape of the building in the seismic zone. (Mohd. Shadab khan, 2018)

Skyscrapers, parking garages, steel & concrete structures, low and high rise structures, and portal frame structures are usually analyzed by the software ETABS. In this article in this article the analysis of the cases includes the behavior of structures with multistorey during earthquake for several irregular plan such as Rectangular, C-shape, L-shape and I-shape. The analysis of a G+14 storey RCC framed building structure is done in the software ETABS. The maximum shear forces, bending moments, and maximum storey displacement are determined after analyzing the building structure and then calculated for all the modelled cases. (Abhay Guleria, 2014)

It is an attempt to determine the effect of Irregular plan configuration for multistoried reinforced concrete building model. This paper mainly gives importance to analysis of a multi-storey building (G+24) which is irregular both in plan and elevation. Modelling of 25 storied building structure with RCC frame is done on the ETABS v13.2.0 software. After analysis of the structure such as Maximum Storey Displacement, Base Shear, Storey Drift, Maximum base reactions, Torsion and Over-turning moments are determined, evaluated and then all the cases values are being compared. (N Mohan Reddy, Dr. E. Arunakanthi, 2015)

In this paper the T-shaped irregular plan tall structure is analyzed using wind load and the parameters are obtained such as base shear(FX),Overturning moment (MY) and Torsional moment (MZ) for the isolated as well as conditions for interference. Wind incidence angles. & effect of interference were measured for isolated condition, the interfering model has same shape and dimensions as that of the instrumented model. Placing of models were done side by side and also as random plan along with it spacing was varied... It was observed that the presence of a neighboring building greatly affects the wind flow pattern

around a building which causes change in the wind loading on the building. The effects of the interference may be either give benefits or it will be adverse that will depend on the position of the interference building structure. . (Ravindra ahlawat, ashok K. ahuja, 2015)

In recent times current architecture describes one of the nice abstract with irregular geometry. Everybody desire to make aesthetical design of attractive as well as structures such as compound type and with shortage of land it is modern requirement to increase the height of the structure & making it as tall structure. But as long as we move towards vertical height of tall structure the wind pressure is exerted with level of extent., which can be very hazardous to life., so it is necessary to examine and recognize such pressures by controlling them .The wind analysis is done for irregular geometry such as T-shape, L-shape and parameters are checked at various heights . The building with 15, 25 and 30 storey is analyzed for both regular and irregular models and it is observed that coefficient of parameter increases with the height of building. . Also path of wind plays extremely necessary part in performance of structure. (Bhumika Pashine, et.al, 2016)

The structural analysis of RCC Multistoried building structures is very complex. The IS code of earthquake load i.e. IS-1893-2002 with its latest version suggests to analyses RCC building in 3-D Systems. The irregularities in plan and elevation of building structures is the main reason behind analysis of 3-D Systems. It has been observed that irregularity leads to unfavorable performance or behavior or the effectiveness during earthquake and IS-codes for earthquake load differentiate between both regular and irregular structures. The behavior of RCC framed buildings is proposed, discussed and highlighted during an earthquake for different cases in the present article. The seismic analysis is done for RCC framed models with different cases such as without shear wall, with shear wall at Centre, with shear wall in X-direction, with shear wall in Y-direction, lastly shear wall in both direction i.e. X & Y. (C.M. Ravi Kumar, et.al, 2013)

This analysis presented the method for seismic assessment of vertically mass irregular RC frame structures depending on an idea of the response spectrum method. When the earlier modern earthquakes in various parts of India and world are concerned, this discloses the matter regarding the vulnerability of existing structures. The existing building structures which were designed and constructed in accordance with earlier Codal provisions do not satisfy condition of present seismic code and design practice. Many RC buildings in urban areas lying in active

seismic zone may undergo moderate to severe damages for the period of future ground motion. Therefore it is necessary to diminish improper danger to property and life of inhabitant. 12-storied building model is used as irregular building in this analysis in 3D-system. The full project is carried out under the software ETABS. The influence of masses is considered in the building at several floors such as 4th floor, 8th floor and 12th floor respectively. The parametric comparison is done for structures with regular frame being compared with irregular frame. The different method used in the analysis is the Equivalent static method and Response spectrum method. Md. Kashif Ansari, Prof. H.S Vidhyadhar, 2016)

There has been usually irregularity in buildings plan and it is found very less in elevation of the building. This enhances a hazardous influence on behavior of structure during earthquake. The comparative analysis is done in between regular and irregular structures with vertical irregularities. The equivalent method is used for the analysis for building with five storey in regular shape during earthquake load acting on it. The seismic analysis is done by using UBC code 1997. There are nine setbacks being made from the regular buildings and analysis is done for each model in which stories are excluded at several heights. The time history analysis and Response spectrum analysis being nonlinear dynamic analysis is used which is carried out by the using software ETABS. The parameter such as storey displacement, base shear, Storey drift, shear force, bending moment are calculated using ETABS by modeling irregular buildings with setbacks. (Qaiser uz Zaman Khan, et. al, 2013)

The seismic behavior of building or a structure is based significantly on its shape, size and geometry taken as a whole. During seismic calamities various buildings with regular shape were executed very well but in comparison to irregular buildings it is observed to be more harmful with damage to property. The response spectrum method is used to analyses the regular plan buildings in the present paper with the latest code of earthquake load namely IS-1893-2002 part-1, along with this method are taken into account to analyses the situation of seismic behavior. The analysis is carried out by various effect of different shapes of the already constructed building being situated in the same region of seismic zone in this article by response spectrum method, with vital importance given to the plan of building being analyzed by response spectrum method, due to various criteria that it gives an important detail for different facts of the world. (Rucha S. Banginwar, 2012).

The authors in this work put emphasis on the usage of wall belt supported system used in multistoried building. This work compares the various possibilities of the

demand and supply of stability enhancement system, since review has done. The lateral load handling capacity has evolved as the main criteria in this work. They secretly revealed their upcoming work with total 14 cases with the usage of response spectrum analysis will be used under Zone 5 with zone factor 0.36 respectively. The Shear wall at corners with belt connecting over its periphery column members was the main idea of their research. After reviewing the various researchers they conclude that their main focus will be shear strip which was the modified part of the concrete wall system. After than their outline of the proposed work was pointed out. In this, they pointed out if the width and thickness were kept fixed and if the height at which the shear strip behaves effective will be their optimum case (Neeraj Patel et. al.).

The research work draws attention to again the stability enhancement system consists of outrigger and belt truss supported system. They have shown the results in technical point of view. The figure in their work shows the effective approach to the stability system applied over a multistoried building. They have performed a software approach with total seven cases created and abbreviated as Case S1 to Case S7 respectively. Fundamental Natural period for the structures were taken as 1.2978 seconds with subjected to the structure rest over hard soil with importance factor is equal to 1. Response spectrum method was used in this approach of earthquake analysis. Their tabular representation was really good since in each of the tables, worst case has shown subjected to the maximum values of the parametric case. After the results performed and showed as per various objectives, conclusions have been drawn. They conclude Case S4 shows the least values among all the seven cases and should be recommend the same (Archit Dangi et. al.).

Research revealed that the interaction of shear wall in connection with the multistoried building under seismic loading was the main criteria of the research. They have described the various possibilities of the location of the shear wall along with the criteria of shear wall type. This increases the stability of the structure with only shear wall at a particular location. The research done with the aim of taking G+9, G+18, G+27 and G+36 storied models conducted over a software approach. They have selected 20m x 20m plan area just to perform the analysis with frames abbreviated as Frame 1 to Frame 12 in each storey. Firstly they showed that what is the meaning of shear wall with its types. Total 48 frames have been constructed and all the structures are supposed to be rested over medium soil at earthquake zone V. After the analysis, conclusions have been drawn. The result proves that the frame 10 i.e. +

shaped shear wall at center with slab proves to be the best of all (Sagar Jamle et. al.).

Researchers in this research work points out the reviewed approach on the effect of the different concrete grade in outrigger and wall belt supported dual structural system. Since same grade approach has been a major part of the work now a days but this kind of approach have been proved the numerous possibilities of the research work in different grades of concrete. Firstly they have shown the concept of multistoried buildings in the urban areas. Then they described the value of outrigger system and after than the belt supported system and the combined effective approach to the general building as per stability point of view. They have conducted numerous literature review related to the same topic and after than conclusions have drawn. The conclusion part has combined with an approach to the outline of the proposed work. They proposed that grade change in outrigger and wall belt supported system will become the major technical part of their study and will going to be major research work (Mohammad Bilal Rasheed et. al.).

This particular work brings out the review effort drafted on shear wall opening criteria of a multistoried building. In introduction, the author described the criteria's to fulfill the earthquake requirements is to make a dual system building which was considered in Indian Standardization too. Shear wall description with its types have also been discussed. The main emphasize has done to classify the core type shear wall viz. single core shear wall and dual core shear wall. Then he clearly described the types of opening in shear wall provided with figuratively approach. After then the numerous reviews on the shear wall usage, its importance and the opening criteria of shear wall was discussed. Lastly, they draw the conclusions and outline of the proposed work, that there should be a criterion describing the percentage deduction of the shear wall area and the percentage usage of the wall area. Their technical work will show the percentage elimination of the same (Gagan Yadav et. al.).

The Exposure of extra load beyond the calculated load over the multistoried building under seismic loading was the worst case taken in their analysis. The authors suggested the optimum location of rooftop telecommunication tower along with its various fixtures and attachments. In introduction, they have suggested the importance of rooftop telecommunication tower in urban areas. Since the working approach was technical findings, they have discussed and set an aim by the various objectives consist of Base shear, axial forces, shear forces, moments and displacements. These parameters selected for both X and Z direction. Then they have described the

methodology adopted for seismic analysis. After than the structure modeling has performed with total 5 cases selected and abbreviated as CASE A to CASE E with different telecommunication tower location. G+ 12 storied residential apartments have selected and all the structures have rested over medium soil at seismic zone 4. After the results, conclusions have been drawn suggested that on comparing all the cases, case D shows optimum amongst all (Suyash Malviya et. al.).

The paper highlights the insight of concrete which can cure itself where the shortage of the water in such areas. The agent used in their research work was polyethylene glycol abbreviated as PEG 400. This particular chemical was replaced by the percentage of cement in their research by 0%, 0.8%, 1.5%, 2.4% and 3.2%. The grade of concrete chosen was M20 and M25 grade of concrete. Both compressive and flexural strength test have been performed since this research work has done first in lab then the results were computed in tabular form and represented by graphical form. The work specially emphasize on 28 days curing results. Total 5 types of replacement mixed have made by replacement of cement and abbreviated as Mix-1 to Mix-5. They have concluded that For M25, 1.6% PEG Mix is efficient and for M20 Grade, 2.4% PEG Mix suited the best (Prakash Mandiwal et. al.).

This particular work give emphasis to the analytical approach of multistorey building wen shear wall is used at different locations and also for different heights. Authors in this work firstly show why we have to implant the structural stability feature when different height of the structure used. UBC analysis was also described in it. Also, they described the importance of providing the shear walls with stiffness and aspect ratios. Advantages of shear wall have also discussed. In methodology section, they provided various input parameters that were used in their work. There were basically three structures viz. G+10, G+20 and G+26 structures rested over medium soil for the analysis. Finite element approach in calculation of stresses of only shear wall have discussed in their approach. Different approached were found out and finally future scope has provided (Priyanka Soni et. al.).

III. CONCLUSIONS AND OUTLINE OF PROPOSED WORK

As per above review of the different papers we found the following objective to study concluded as below:-

1. The irregular shape used in the different papers includes only shapes such as H-shaped, L-shaped, T-

shaped, V-shaped, U-shaped, I-shaped, etc. as a whole building structure.

2. The papers only study about effects of parameters such as torsion, shear force, bending moment, Storey drift, etc.
3. The irregularity in the buildings can be done by making floor in different directions such as east, west, North and south etc.
4. The Comparative study can also be done by changing the grades of concrete in multistorey building.

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